Mississippi, Ohio, and Tennessee; Illinois reporting the maximum. In the remaining states they were either not observed at all or on very few dates.

But few lunar halos were reported from the 1st to 13th, there being seven days during that period on which none were reported; from the 14th to 20th they were observed in from five to fifteen states and territories, and during the balance of the month they were of rare occurrence. They were seen on from five to twelve days in Alabama, Connecticut, Illinois, Missouri, New Jersey, New York, Pennsylvania, Tennessee, and Virginia; in the remaining states and territories they were either not observed at all or on a small number of dates.

The phases of the moon, Washington mean time, during August, as given in "The American Ephemeris and Nautical Almanac," are as follows: new moon, 7th, 1h. 12.7m.; first quarter, 13th, 23h. 35.8m.; full moon, 20th, 23h. 12.1m.; last quarter, 28th, 21h. 9.7m.; apogee, 13th, 18.9h.; perigee, 27th, 19.6h.

METEORS.

Sebastian, Fla.: a meteor, apparently one-half the size of the full moon, was observed in the east at 6.50 p. m., 12th; it moved in a westerly direction, and when about 10° from the horizon it exploded with a loud report like that of a cannon; the meteor left a long trail in its path which lasted about thirty seconds. It is reported that the same meteor was seen and heard to explode about ten miles from this place.

The following is taken from "Science" of September 14th:

Mr. A. B. Knight, of Butte City, Montana, reports that on the evening of August 19th a brilliant meteor was observed from that city, and the following is the results of observations made by Mr. J. C. Mayo: "At 6.35 p. m. (local time) a meteor burst into view in the southern heavens, and moved in an apparent downward and northeasterly direction. About two seconds (estimated) after its appearance the meteor burst, first into two parts, and then into fragments, which disappeared. At the expiration of five minutes and thirty seconds two loud reports, nearly simultaneous, were heard. These reports were like the explosion of heavy blasts of powder, and were followed by a rumbling, like near thunder, lasting about ten seconds. The place in the sky where the meteor was first seen was S. 60° E. from the Blue Bird Mine, at an elevation of 50° from the horizon. The place where it burst was due east and at an elevation of 25°. The meteor was a well defined body, egg-shaped, with the smaller end foremost. This body was distinctly visible, 'resembling white-hot iron', giving off a pure white light, and was followed by a 'bright blaze', which shaded into a dense white, 'sulphurous' smoke. The trail of smoke left behind remained visible for fully ten minutes. The sky was clear and the sun shining brightly, but the meteor apparently emitted as much light as the sun, and lighted up its shadows".

The meteor above referred to was also observed at Deer Lodge, Boulder, Helena, and Virginia City, Mont.

Fort Maginnis, Mont.: a brilliant meteor was observed, moving from a point a little east of north in a westerly direction, at 9 p. m., 19th; the meteor, when passing, lit up the surrounding objects.

Brock's, Emery Co., Utah: a brilliant meteor was observed in the northeast at an altitude of 60°, moving in an easterly direction, at 7.22 p. m., 21st, and disappearing when about 2° above the horizon; the meteor left a reddish train of light, which lasted about one and three-quarter seconds. Twelve meteors were observed from evening twilight until 11.30 p. m., 22d, moving from the zenith to the horizon in the eastern and northern sky; each emitted a bright light like the electric light, and lasted from one-half to three-quarters of a second.

Salina, Saline Co., Kans.: a brilliant meteor, of fiery red color, was observed, moving from southeast to northwest, at 9 p. m., 29th; during its flight the sky was lighted up as if by bright moonlight for fully fifteen seconds. This meteor was also seen at Manhattan and other points in Kansas.

Meteors were also observed as follows: 1st, Auburn, Ala.; Dudley, Mass.; Kalamazoo, Mich. 2d, Kalamazoo, Mich.; Fort Stanton, N. Mex.; Cleburne and Mesquite, Tex. 3d, Manatee, Fla.; Kalamazoo, Mich.; Collinwood, Ohio; Cleburne and Mesquite, Tex. 4th, Yuma, Ariz.; Pekin, Ill.; Kalamazoo, Mich.; Cleburne and Mesquite, Tex. 5th, Yuma, Ariz.; Webster, Dak.; Archer, Fla.; Boisé City, Idaho; Kalamazoo, Mich.; Cleburne and Mesquite, Tex.; Marion, Va. 6th, Keeler, Cal.; Manatee, Fla.; Kalamazoo, Mich.; Utica, N. Y.; Quakertown, Pa.; Cleburne and Mesquite, Tex.; Marion, Va. 7th, Fort Stanton, N. Mex.; East Portland, Oregon; Quakertown, Pa.; Stateburg, S. C.; Cleburne and Mesquite, Tex.; Lynchburg and Marion, Va. 8th, Pekin, Ill.; Vevay, Ind.; Garrettsville, Ohio; Mesquite, Tex.; Deuster, Wis. 9th, Auburn, Ala; Yuma, Ariz.; Duke, Fla.; Cedar Rapids, Iowa; Lexington, Ky.; Dudley, Fall River, and Somerset, Mass.; Winnemucca, Nev.; Wauseon, Ohio; Quakertown, Pa.; Austin and Memphis, Tenn.; Brownsville, Tex. 10th, New Market, Ala.; Prescott, Ariz.; Lead Hill, Ark.; Sacramento, Cal.; Webster, Dak.; Cedar Keys, Fla.; Charleston, Ill.; Cedar Rapids, Iowa; Blue Hill Observatory, Dudley, Fall River, and Somerset, Mass.; Kalamazoo, Mich.; Biloxi, Miss.; Winnemucca, Nev.; Beverly, N. J.; Brownsville, Tex.; Lynchburg, Marion, and Rappahannock, Va. 11th, Lead Hill, Ark.; Cedar Rapids, Iowa; Kalamazoo, Mich.; Saint Vincent, Minn.; Moorestown, N. J.; Marion and Rappahannock, Va.; Deuster, Wis. 12th, Keeler, Cal.; Jacksonville, Ill.; Kalamazoo, Mich.; Brownsville, Tex. 13th, Kalamazoo, Mich. 14th, Kalamazoo, Mich.; Wauseon, Ohio; Brownsville and Mesquite, Tex. 15th, Kalamazoo, Mich.; East Portland and McMinnville, Oregon; Quakertown, Pa.; Brownsville and Mesquite, Tex. 17th, Monticello, Iowa. 18th, East Portland, Oregon. 19th, Boisé City, Idaho; Virginia City, Mont.; Utica, N. Y. 21st, East Portland, Oregon; Mesquite, Tex. 22d, Jacksonville, Ill.; Vevay, Ind.; Beverly, N. J. 23d, Yuma, Ariz.; Windsor, Ill.; Kalamazoo, Mich.; Brock's, Utah. 24th, Jacksonville, Ill.; Vevay, Ind.; Dudley, Mass.; Kalamazoo, Mich. 25th, Keeler, Cal.; Pekin, Ill.; Kalamazoo, Mich.; Egg Harbor City, N. J. 26th, Woonsocket, Dak.; Dudley, Mass. 27th, Dudley, Mass.; Biloxi, Miss.; Eden Centre, N. Y.; Wauseon, Ohio; Quakertown, Pa. 28th, Keeler, Cal.; Vevay, Ind.; Clarinda, Iowa; Manhattan, Topeka, and Yates Centre, Kans.; Dudley, Mass.; Tecumseh, Nebr. 29th, Glenwood, Iowa; Dudley, Mass.; Beverly, N. J. 30th, Kalamazoo, Mich.; Collinwood, Ohio; Cleburne, Tex.; Deuster, Wis. 31st, Jaksonville, Ill.; Helena, Mont.

MIRAGE.

Kitty Hawk, N. C.: a mirage was observed to the east, north, and south of this place from 9.48 to 11.10 a. m. 22d; vessels eight miles from shore appeared in both natural and inverted positions; life-saving stations thirty miles north of here appeared very near and elevated along the beach; and forests were depicted in the sky in an inverted position.

Mirage was also observed as follows: Davenport, Dak., 9th, 12th, 15th, 19th, 22d; Webster, Dak., 4th, 18th, 19th, 21st to 25th, 28th, 29th, 31st; Hampton, Iowa, 2d, 28th; Moorhead, Minn., 12th, 15th; Marquette, Nebr., 23d, 29th.

SAND STORMS.

Rio Grande City, Tex., 5th to 8th, 19th; Fort Grant, Ariz., 12th, 15th; Fort McDowell, Ariz., 13th, 14th, 24th; Winnemucca, Nev., 16th, 17th.

VERIFICATIONS.

INDICATIONS FOR 36 HOURS IN ADVANCE.

The percentages of verifications of the bi-daily indications for July, 1888, as determined from comparison of succeeding telegraphic reports, are given in the table below.

The predictions for districts east of the Rocky Mountains for July, 1888, were made by Assistant Professor H. A. Hazen, and those for the Pacific coast were made by 2d Lieutenant Joseph E. Maxfield, Signal Corps; the verifications for all districts were determined by Assistant Professor C. F. Marvin.

Percentages of indications verified, July, 1888.

States.		States.	
Maine	67.0	Ohio	81.0
New Hampshire	70.2	West Virginia	78.8
Vermont	72.3	Indiana	80.9
Massachusetts	68.5	Illinois	78.2
Rhode Island	69.5	Lower Michigan	74.7
Connecticut	70.4	Upper Michigan	75.4
Eastern New York	71.0	Wisconsin	75.1
Western New York	76.6	Minnesota	75.2
Eastern Pennsylvania	71.2	Iowa	75.4
Western Pennsylvania	79.8	Kansas	75.5
New Jersey	70.6	Nebraska	74.1
Delaware	72.6	Missouri	72.4
Maryland	70.7	Colorado	74.0
District of Columbia	76.3	Eastern Dakota	72.5
Virginia	76.8	Southern California*	87.5
North Carolina	79.7	Northern California*	88.0
South Carolina	79.7	Oregon*	78.6
Georgia	77.7	Washington Territory*	77.8
Eastern Florida	82.1	*By elements:*	
Western Florida	76.2	Weather	82.0
Alabama	74.8	Temperature	64.7
Mississippi	73.0		
Louisiana	74.3	Monthly percentage of weather and temperature combined	75.1
Texas	80.5		
Arkansas	75.4		
Tennessee	76.2		
Kentucky	78.8		

*From the 1st to the 11th, inclusive, the predictions were made for twenty-four hours, beginning nine hours after the observations on which the predictions were based; during the remainder of the month they were made for thirty-six hours, beginning with the observation on which they were based. In determining the general average percentage for the different elements, the Pacific coast states have not been included.

INDICATIONS FOR 24 HOURS IN ADVANCE.

The percentages of verifications of the bi-daily indications for August, 1888, as determined from comparison of succeeding telegraphic reports, are given in the table below.

The predictions for all districts for August, 1888, were made by 1st Lieutenant Robert Craig, 4th Artillery, Acting Signal Officer and Assistant, and the verifications of the same were determined by Assistant Professor C. F. Marvin.

Percentages of indications verified, August, 1888.

States.		States.	
Maine	72.6	Ohio	81.4
New Hampshire	73.4	West Virginia	80.5
Vermont	75.1	Indiana	75.5
Massachusetts	80.7	Illinois	75.4
Rhode Island	85.5	Lower Michigan	75.1
Connecticut	84.8	Upper Michigan	79.5
Eastern New York	77.5	Wisconsin	79.5
Western New York	77.2	Minnesota	73.0
Eastern Pennsylvania	84.5	Iowa	74.3
Western Pennsylvania	79.4	Kansas	76.2
New Jersey	84.3	Nebraska	79.5
Delaware	89.0	Missouri	73.1
Maryland	85.2	Colorado	77.2
District of Columbia	81.0	Eastern Dakota	77.4
Virginia	83.2	Southern California	....
North Carolina	79.0	Northern California	....
South Carolina	77.3	Oregon	....
Georgia	72.5	Washington Territory	....
Eastern Florida	78.0	*By elements:*	
Western Florida	72.6	Weather	82.0
Alabama	74.6	Temperature	72.2
Mississippi	72.7		
Louisiana	73.3	Monthly percentage of weather and temperature combined	78.1
Texas	83.2		
Arkansas	70.6		
Tennessee	77.5		
Kentucky	78.5		

The following extracts from the official instructions governing the verifications of the predictions of the Signal Service are given:

The monthly percentages of verifications of predictions of weather and temperature for each state and territory will be combined by multiplying the respective percentages of verifications of predictions of weather by six (6), and of temperature by four (4), and dividing the sum of the respective products by ten (10). The quotient will be the average percentage of verifications of predictions of weather and temperature for the particular state or territory and month in question.

The general monthly percentage of verifications of all indications will be determined by multiplying the general monthly percentage of verifications of weather and temperature combined by five (5); of the display of cautionary and storm signals by two (2); of cold waves by one (1); and dividing the sum of the products by eight (8); except during those months in which not more than three cold-wave signals are ordered, when cold waves will be omitted and the sum of the remaining products will be divided by seven (7). The quotient will be the general monthly percentage of verification of all indications.

CAUTIONARY SIGNALS FOR JULY.

Statement showing percentage of justifications of wind signals for the month of July, 1888: Number of cautionary signals ordered, nineteen; justified, wholly or in part, sixteen. Number of storm signals ordered, two; justified, two. Number of signals ordered for easterly winds, one; justified, one. Number of signals ordered for westerly winds, eighteen; justified, fifteen. Number of storms without signals, twelve. Number signals ordered late, or after the justifying velocity had begun, six. Percentage of justifications, 58.0.

CAUTIONARY SIGNALS FOR AUGUST.

Statement showing percentage of justifications of wind signals for the month of August, 1888: Number of cautionary signals ordered, ten; justified wholly or in part, five. Number of storm signals ordered, sixteen; justified, wholly or in part, fourteen. Number of signals ordered for easterly winds, eighteen; justified, sixteen. Number of signals ordered for westerly winds, eleven; justified, five. Number of storms without signals, thirty-three. Number of signals ordered late, or after the justifying velocity had begun, three. Percentage of justifications, 45.6.

LOCAL VERIFICATIONS.

The following extracts from the published reports of the state weather services for August, 1888, show the percentages of verification of weather and temperature signals:

Indiana.—Crawfordsville: During the month the temperature signals received were verified each day, but the weather signals missed seven times.

Worthington: Twenty-one weather predictions were verified, and five not verified; twenty-four temperature predictions were verified, and two not verified.

Michigan.—Weather signals are now displayed in one hundred and thirty-two towns in the state, and upon the baggage-cars of twenty-six trains of eight of the principal railroads of the state.

The indications are issued at 10 p. m., daily, from the Chief Signal Office, Washington, and are for the twenty-four hours from 7 a. m. to 7 a. m.

The percentage of verification of these indications for August is as follows (the verification is taken from reports of displaymen furnished this office monthly): temperature, 77.7 per cent; weather, 70.3 per cent.; temperature and weather, 74.0 per cent.

Weather signals are displayed on the baggage cars of the following railroads: C. & G. T. R'y; D., G. H., & M. R'y; D. D. G. T. R'y; M. C., main line and branches; C. & W. M. R'y; G. R. & I. R'y; P. H. & N. W. R'y; and the P. O. & P. A. R'y.

Minnesota.—The verification of weather signals were: 77 per cent. for weather, and 80 per cent. for temperature.

Nebraska.—The percentages of correct weather predictions for the state were: temperature, 89.6; weather, 88.1; mean, 88.8.

South Carolina.—The percentage of verification of the weather and temperature predictions for the state was: weather, 70.0; temperature, 88.0.

Tennessee.—The percentage of verification of weather and temperature predictions for the month at the following stations were: Jonesborough, weather, 96.3; temperature, 96.3. Clarksville, weather, 63.0; temperature, 88.8. Mason, weather, 96.3; temperature, 96.8.

STATE WEATHER SERVICES.

The following extracts are republished from reports for August, 1888, of the directors of the various state weather services:

ALABAMA.

The month opened with the rainfall about an average and the crops greatly benefited by the favorable season, but towards the close the rains were almost continuous, and during this period farming interests were greatly damaged. This condition of the weather was evidently produced by the range of atmospheric pressure over the United States during the month. On the 7th low pressure occurred in northwestern Texas and high in the northeastern and northwestern portions of the United States. The result of the struggle between these two opposing forces was rain over the Gulf States from the 4th to the 8th. On the 18th, 19th, and 20th low barometer was recorded in the Gulf States and high off the Atlantic and in the Northern States. On the 20th the low pressure began to move northeastward, and heavy rains were produced in Alabama. From the 21st to the 29th low pressure was forced